PATENT SPECIFICATION

(11) 1 530 716

(21) Application No. 46353/76 (22) Filed 8 Nov. 1976 (19)

(31) Convention Application Nos. 2 550 213 (32) Filed 8 Nov. 1975
2 550 409 10 Nov. 1975
2 557 970 22 Dec. 1975 in

(33) Fed. Rep. of Germany (DE)

(44) Complete Specification published 1 Nov. 1978

(51) INT. CL.^{2} E05B 65/12 65/36

(52) Index at acceptance
E2A C4A

1 530 716

(54) LOCKS AND CATCHES FOR VEHICLES

(71) We, FICHTEL & SACHS AG, a German Body Corporate, of 62 Ernst-Sachs-Strasse, Schweinfurt am Main, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention concerns an automatic shutting and/or locking mechanism for vehicle doors, especially of motor vehicles. It is intended for series or subsequent installation and serves the purpose of easy and absolutely secure and complete shutting and of automatic locking of the passenger compartment doors and also, with advantage, of additional doors and lids such as, for example, the bonnet lid, the boot lid or special loading doors.

A large number of automatically operating shutting and locking mechanisms, including some with energy storage for the shutting device, is known, They are a standard fitting in some models of private cars.

In these systems, the power required for shutting and locking is drawn either from a hydraulic power system, from a pneumatic vacuum installation, powerful electromagnets, adjustable electro-motor drives or also from a spring which is compressed by opening the vehicle door.

The locking mechanisms are normally controlled by a central system. They are operated *via* electrical contacts or pneumatic valves which are activated *via* the ignition lock on locking one of two doors of the vehicle and/or by signals from the speedometer cable or other devices indicating the movement of the vehicle.

The aim of al these devices is that, when the vehicle is parked or put away, the locking of only one vehicle door shall lock all other doors, lids, bonnets and covers on the vehicle and also to lock all doors when the vehicle is ready to be driven.

Known mechanisms of this kind as used in vehicle and aircraft manufacture are required to fulfil this task with the aid of very considerable, technically complicated and above all costly methods which are liable to break down because they make use, in the main, of power systems on a hydraulic, pneumatic or electromagnetic basis which, in the majority of cases, and particularly for the purpose of locking doors, are fitted in the vehicle.

If the equipment functions by means of a vacuum, which is usually generated by the reduced pressure in the induction pipe of petrol engines—this solution is not feasible with Diesel engines—then, in addition to numerous control valves and pipelines to the doors, a vacuum chamber is also necessary. Leaks in the pipelines and transmission system, which are difficult to detect, frequently lead to failure of the installation.

Similar difficulties arise in the case of hydraulically operated systems. If the system is operated by electromagnets, these are large, heavy and expensive, and consume a lot of current, so that in many cases a larger battery has to be fitted in the vehicle, seeing that the power required to close a vehicle door securely is in the region of 500 newtons, and to lock it of the order of 50 newtons. A not inconsiderable structural outlay is required for the control and regulation of pneumatic and hydraulic valves and relays for high current levels. Above all, it is not possible, with the suggested solutions, to instal them additionally or subsequently in vehicles, or at least not without major modifications to the existing locking mechanism of the door-closing system actuated by locks and hand-operated locking buttons.

The dimensions of these hydraulic cylinders, servo vacuum boxes or solenoids acting in two directions, which have to be installed in the door frame or in the door, are usually so large that they can be fitted only in doors with deep door frames, that is to say, in large vehicles.

The present invention may provide a door shutting and/or locking system for vehicle doors which is small, light and cheap, and made up of simple components, which operates, when in the "closed" position or when locked, without any holding power, which can be universally used and installed either immediately or subsequently, as required,

18, to which the usual press knob 19 for manual locking is secured, passing through the door frame 20. In the version shown, a bellows 21 acts as a dust excluder.

If current is now fed to the electromotor, with the motor rotating in a clockwise direction, for the locking process, either by the operation of the door lock contact on closing a vehicle door, or when the vehicle moves off, e.g., by a transmitter on the speedometer cable, then the electromotor can or will accelerate the flywheel mass, including in particular the flywheel 4. In so doing, the motor drives, not only the flywheel, but also the reduction gear or transmission gear consisting of the gear wheels 5, 6 and 8. The rotation of the motor 2 in a clockwise direction results in an anti-clockwise rotation of the gear wheels 6 and 8 and in a downward movement of the sleeve section 10 from the position shown in Fig. 1, initially until the no-load stroke 22 between the sleeve section 10 and the spring-loaded stop disc 16 has been overcome. The sleeve section 10 then comes up against the disc 16 of the lower stop of the pull rod 12. On moving further downwards, the sleeve section 10 now takes the pull rod 12 with it, upon which the energy of rotation of the flywheel 4 is transmitted to the pull rod 12, the locking lever is drawn downwards and locking is thus effected. This "no-load stroke" or "idle travel" in the transmission of power between the locking lever 18 and the flywheel 4 means that no coupling needs to be present, with the result that the toothed wheels or toothed racks are in permanent engagement. The design is consequently very simple and reliable.

The locked position is shown in Fig. 2. The motor 2 is switched off by the central control unit, which wil be described in more detail, before this final position is reached. For this purpose, the control unit may contain a timing relay or some other timing device, possibly in the form of a single-shot multivibrator (MM), which supplies current to the motor for a limited period only on the occasion of each locking or unlocking operation. Unlocking from the position shown in Fig. 2 back into that of Fig. 1 takes place in a corresponding manner, only the direction of rotation of the motor 2 being reversed by altering the direction of the current. Alteration of the direction of the current will be explained later in greater detail with the aid of the circuit for the central control unit shown in Fig. 7. During the unlocking procedure, the no-load stroke 22a is provided by the initial distance between the upper end of the sleeve section 10 and the upper stop 13. As long as the sleeve section 10, during its upward movement from the position shown in Fig. 2, is performing the no-load stroke 22a, the motor 2 can accelerate the flywheel to a high speed of rotation.

The disc 16 on the lower stop is movable along the pull rod 12, while the securing unit 14 is mounted rigidly on the pull rod 12. The spring 15 has three purposes. In the first place, it alleviates the blow when, in the course of the locking operation, the sleeve section 10 and the disc 16 come up against one another; secondly, it helps to absorb the blow on the limit stop when the position shown in Fig. 2 is reached, and also, and this is important, in the locked position shown in Fig. 2, in which the sleeve section 10 has been shifted downwards, it is possible to lift the locking button 19 manually, at increased effort, against the pressure of the spring 15, thereby opening the door, without the necessity of turning the transmission shaft with the spur wheel and the electromotor.

The simplest form of an automatic locking mechanism with electromotor powered energy storage is shown in sketch form in Figs. 3 and 4. Mounted on the shaft 3 of the electromotor 2 are the flywheel 4 and a small friction wheel 23 which is pressed by the flexibly mounted motor against the large friction wheel 24. The crankpin 25 fixed to the latter engages in a slot 26 in the connecting rod 27, which is linked so that it can pivot to the locking lever 18.

On its outside diameter, the large friction wheel also has a radial stop pin 28 which, by striking against a part, not illustrated, on the housing, which is also not shown, limits the angle of rotation of the large friction wheel to about 350°. Fig. 3 shows the beginning of the locking operation after the large friction wheel has rotated anti-clockwise through about 70° from the unlocked position. The electromotor 2, with the flywheel 4 and the friction wheel 23, rotate clockwise as in the drawing in Fig. 3. After rotating through a further angle of 100°, by which time the crank pin 25 has reached the left-hand horizontal point A of its circular path, the no-load stroke has been passed and, in the subsequent rotation of the large friction wheel 24 through 90°, the locking process is completed. This is to say that, at point A on its circular path, the crank pin 25 encounters the lower end of the slot 26 and, in the following movement phase, draws the connecting rod 27 and, with it, the locking lever 18, downwards. It follows that, during the no-load stroke, the flywheel is accelerated to a high speed, thus enabling it, during the following operating stroke, to generate the energy required to pull down the lever 18.

Fig. 4 shows the unlocking procedure after the large friction wheel 24 has rotated clockwise through an angle of some 70°. Here, too, there is an initial no-load stroke until the crank pin 25 reaches the upper end

of the slot 26 and then forces it upwards. Characteristic of this version in accordance with Figs. 3 and 4 is its particularly simple design and the possibility, in the course of the locking operation and the unlocking operation, of accommodating some 170° of no-load stroke or acceleration path for the acceleration of the flywheel at only 90° working travel and 80° idle deceleration path. As a result, using the smallest possible electromotor, in terms of size and performance, it is possible to bring a medium-sized flywheel up to a high speed of rotation and to the storage of the energy required for the work of locking and unlocking.

The illustration in Fig. 5 shows, in part section, the construction of a flywheel energy store powered by an electromotor with preliminary worm reduction gear, rack and pinion drive and a separately mounted flywheel. This solution is especially suitable for the locking of relatively heavy doors, such as those fitted to omnibuses. In this case, the electromotor 2 is flange-mounted on the housing 1, and its shaft 3 engages in the worm shaft 29 which also carries the flywheel 4. The energy of the flywheel is transmitted *via* the worm 30, the worm wheel 31 and the gear wheel 8 to the sleeve section 10 by means of the toothed rack 9. The remaining components of Fig. 5, which bear the same reference numbers as the parts in Figs. 1 and 2, together with the no-load stroke 22 (and the no-load stroke 22a which, however, is not to be seen in Fig. 5) for accelerating the flywheel and the rest of the locking and unlocking procedure correspond to the version of the invention shown in Figs. 1 and 2.

Fig. 6 shows diagrammatically the installation of automatic locking devices with electromotor powered energy storage in a vehicle with four doors 32 and additional locking of the bonnet 33 and boot lid 34.

The locking units 35 in accordance with the invention, together with the locking buttons 19, which can also be operated manually, are fitted in each door and at the front and rear of the passenger compartment. Twin current supply wires 36 (shown as broken lines) lead from them to the central control unit 37.

A twin electrical control lead 38a (shown as a dotted line) runs from the door lock 38 on, for example, the driver's door, to the central control unit 37.

A single-wire control ring lead 39 (shown as a chain line), which connects in series the contact makers 40 in the door frames and in the coachwork in the vicinity of the bonnet lid 33 and the boot lid 34, also runs to the control unit. The contact makers 40 prevent the locking mechanisms from operating before all doors, bonnets and lids are firmly closed. This control device can be dispensed with in the case of simple versions.

A trip switch 41 for manual operation is also fitted in the passenger compartment so that, even if the vehicle is occupied and stationary, the locks can be operated in the event of threats from outside. The trip switch 41, like the door lock 38, is connected *via* a twin electrical lead 41a to the control unit 37.

Fig. 7 depicts the basic circuitry of the central control unit 37, with the four connected motor 2 for the locking units 35, four control contact makers 40 in the door frames, a contact 42 for the door lock 38 and the connection for the additional trip switch 41.

The central control unit 37 is located in a tightly closed box, which is not shown in Fig. 7. It can to a large extent be made up in accordance with up-to-date digital integral circuit technology, on the lines of the MOS technique.

The switch contacts 41 and 42 are connected in parallel to a block 43. The block 43 contains a form of signal converter, the purpose of which is to prevent, in a known manner, the possibility of contact chatter of the switch contacts 41 and 42 from having an adverse effect on subsequent switching. As a result, chatter-free switching signals occur at the outputs 43a and 43b when one of the switch contacts 41 or 42 is switched over. The two outputs 43a and 43b of the block 43 are connected to the inputs R and S of an RS flipflop 44 or to some other bistable device which can, for example, also take the form of a relay. The outputs of the block 43 are also connected with the inputs of a timing device, in the form, for example, of a single-shot multivibrator 47 which emits at its outputs 47a and 47b a signal of specific, adjustable duration each time that one of the switch contacts 41 and 42 is switched over, that is to say, into the "lock" position (a) or the "unlock" position (b). The output 47b of the timing device is connected via a further timing device 47^1 to a third input L of the flipflop 44. As long as there is a signal at the input L of the timing device 47^1, then, irrespective of its other input signals, the flipflop cannot be switched to another state.

The output 47a of the timing device 47 is connected to one input of each of two blocks 45 and 45^1 for releasing the direction. A further input of the block 45 is connected to the Q output of the flipflop 44, and a second input of the block 45^1 to the $\overline{Q}$ output of the flipflop 44. Finally, the output of an additional timing device or delay element 49 is connected to a third input of the block 45^1, and the importance of this will be explained later.

Two switching amplifiers 46, which can, for example, consist of a transistor with a

connected relay, are connected to the outputs of the blocks 45 and 45^1. The DC motors 2 are connected in parallel to circuits 36 and 39. The circuit 39 is the ring circuit which connects the control contact maker 40 in series. The circuits 36 and 39 are in each case connected to both switching amplifiers 46.

The mode of operation of the block wiring shown diagrammatically in Fig. 7 is as follows. Assuming that one of the switch contacts 41 or 42 is set in such a way that the movable earthed contact is connected to the fixed contact a, with a view to initiating a locking operation of the locking units by means of the motors 2, then, as a result of this switching over, a chatter-free signal occurs at the output 43a of the block. This signal reaches the flipflop 44 and the timing device 47, whereupon the flipflop tilts into one of its two stable conditions and emits a signal at its output Q. At the same time, a signal appears at the outputs 47a and 47b of the timing device and disappears again after a preset time. With the signal at the output 47b of the timing device 47, the timing device 47^1 also emits a signal at the L input of the flipflop 44. As long as this signal from the timing device 47^1 continues at the L input, the flipflop cannot tilt back into its other stable condition, even if, during this period, one of the switch contacts 41 or 42 is switched over to b. Because the position of the flipflop 44 determines, in a manner to be described later, the direction of rotation of the motors 2, the signal at the blocking input L of the flipflop can prevent reversal of the direction of current to the motors while they are running.

The block 45 transmits a signal to the switching amplifier 46 allocated to it for as long as the signals from the output 47a of the timing device 47 and from the output Q of the flipflop are simultaneously present. This logical linking within the block 45 can be achieved, for example, by means of an AND gate or a NAND gate. The output signal from the block 45 has the effect of energising a relay in the switching amplifier 46. The operating contacts of this relay, which are not shown, connect the leads 36 and 39 with the terminals of a source of direct current, also not shown, from which the control unit 37 is also supplied. Let us assume that, because of the direction of rotation of the motors 2 required for the locking operation, the wire 39 is connected to the positive, and the wire 36 to the negative terminal of the source of current. When all the doors and lids are closed, so that the corresponding control contact maker 40 is also closed, the motors 2 are now energised and accelerate their corresponding flywheels.

The period of the timing device 47 is adjusted so that the motors 2 are switched off again before the locking unit reaches the final locked position. On expiry of this period, the output signal from the outputs 47a and 47b of the timing device ceases, and, with it, also that from the block 45. Thereupon the relay of the corresponding switching amplifier 46 drops, so that the supply of current to the motors 2 is cut off. The motors do not stop immediately the power supply is switched off, but continue to run from their own inertia and/or that of the flywheel. The period of the timing device 47^1 is adjusted so that, after the cessation of the signal from the output 47b of the timing device, a locking signal remains at the locking terminal L of the flipflop for as long as the motors continue to rotate after they have ceased to be excited. Only when the motors 2 have ceased to rotate, or when the output signal from the timing device 47^1 at the terminal L of the flipflop 44 has disappeared, can the latter, by reason of the positioning of one of the switching contacts 41 or 42 on the contact b, be tilted into the other stable state.

The operation of the control unit 37 for the unlocking process is the same as for the locking process described. When, for unlocking, one of the switching contacts 41 or 42 is switched to the contact b, the output signal from the block 43 appears at the output 43b, instead of the output 43a, as previously. The flipflop 44 therefore tilts into the position in which the signal occurs at its output $\overline{Q}$, instead of at the output Q in the locking process. The signal from the output 43b of the block 43 has the same effect on the timing device as that from the output 43a. In this case, therefore, the signals from the timing device 47 and from the flipflop 44 occur simultaneously at the inputs of the block 45^1, which contains a logical circuit corresponding to the block 45 and transmits an output signal to the second switching amplifier 46 allocated to it. The second switching amplifier resembles the first, with the single exception that it connects the lead 39 with the negative terminal of the battery, which is not illustrated, and the lead 36 with the positive terminal. In consequence, the direction of rotation of the motors 2 is reversed for the unlocking process. The subsequent switching off of the motors 2 is controlled by the timing devices 47 and 47^1 in the same way as with the locking procedure.

48 is a switch which operates on sudden deceleration or acceleration of the vehicle such as occurs in the event of an accident or collision (8—10 g). When the switch 48 has operated in such an event, the timing device 49, which can also take the form of a single-shot multivibrator, gives an out-

put signal, not immediately, but only after a certain delay, and for a specified period. The output of the timing device 49 is also connected to the block 45¹. The logical wiring in the block 45¹ is so designed that an output signal from the timing device 49 results, irrespective of the signal position at the output 47a of the timing device 47 and at the output $\overline{Q}$ of the flipflop, in an output signal from the block 45¹ which causes the motors 2 to be switched on in the unlocking direction of rotation. In the case of the parallel wiring illustrated of the motors 2 of all the locking units 35, each new operation of the switch contacts, i.e., of the trip switch 41 or of a door lock 38, with its contacts 42, leads to enforced synchronisation of the individual motors or locking units, should one or more locking units be moved manually into another position between two operations of the switch contacts.

It follows that, apart from the control contact makers 40, which are not absolutely essential but are none the less desirable, all control and switching elements are contained in the central control unit 37. The door locks and the necessary number of locking units are each connected by only a twin lead to the central unit, and this greatly facilitates installation, enhances operating reliability and makes subsequent fitting very simple.

The same principle of electromotor powered energy storage applies also to the automatic door shutting mechanism, such as is shown in Figs. 8 to 11, for the four typical positions of a vehicle door during the action of shutting it. The purpose of a door shutting device is to close the door firmly.

In the embodiment exemplified, the use is shown of the shutting device for a vehicle door 32, which is shut by means of a forked lever 51 mounted on a rotating locking shaft 50, in which the forked lever 51 engages in the lug 52 fitted to the locking column of the vehicle and is connected to the mechanical shutting and locking mechanism located inside the door. This latter, being of a familiar nature, is not shown in the drawing. The supplementary automatic door-shutting device in accordance with the invention comprises the housing 1, with the electromotor 2 and the motor shaft 3, mounted on which are the flywheel 4 and the worm 30 in which the worm wheel 31 engages and, in this particular embodiment, has a central internal thread 53 surrounding a threaded spindle 54. The wormwheel is mounted in a suitable manner in the housing 1 so that it cannot be axially moved. A thrust rod 56 is fitted to the bolt head 55 at the end of the threaded spindle 54 projecting from the housing 1, and the bolt 58 of a lever 59 additionally mounted on the locking shaft 50 engages in the slotted hole 57 of this thrust rod 56.

In the position of the door shown in Fig. 8, in which the door lug 52, in the initial position, is just engaging in the forked lever 51 and the locking shaft 50 is about to start to rotate, a contact connected to it, but not illustrated, is operated and establishes the supply of current to the electromotor 2.

Because the preliminary shutting movement of the door which, in practice, is about 20 to 25 mm, is very quickly passed through without any great additional resistance, and the time required for this is, in general, insufficient to bring the flywheel up to an adequately high speed of rotation, there is, between the bolt 58 and the slotted hole 57, an element of "idle travel" 60, which ensures the period of acceleration required to run the flywheel up without load. This is shown in Fig. 9. If the door is slammed with considerable physical force, then the mercury switch switches on the electromotor for only a very short period, so that the automatic system is barely able to operate.

The threaded spindle is screwed downwards by the electromotor via the wormwheel 31. In the process, the thrust rod 56 also moves downwards over the bolt head 55. During the movement as far as contact of the upper edge of the slotted hole 57 with the bolt 58, only a small amount of power is required, with the result that, during this movement and time, the flywheel can be brought up to an adequate speed, thus enabling energy to be stored. As soon as the upper edge of the slotted hole 57 comes to rest against the bolt 58 of the lever 59, the thrust rod 56, driven by the energy stored in the flywheel, pulls the bolt 58, together with the lever 59, downwards. At the same time, the lever 59 rotates the locking shaft 50 and, with it, the forked lever 51 to the left in an anti-clockwise direction, so that the door 32 is pulled and ultimately brought into the closed position, as is shown in Fig. 10. Depending upon the moment of inertia of the flywheel and the overall internal reduction gearing of the worm drive, the door is brought into its end position with considerable force, amounting to 500 to 1000 newtons (50 to 100 kg).

In this case, the timing device 37 built into the central control unit 37 and the flipflop 44 can be connected up in such a way that, when the end position shown in Fig. 10 is reached, there is a reversal of the polarity of the current supply, with reduced voltage, with the result that the motor brings the flywheel 4 and, with it, also the worm 30 and the worm wheel 31, the spindle 54 and the bolt head 55, and the thrust rod 56 into the initial position shown in Fig. 8, without, however, turning the lever 59 on the locking shaft 50, because the return idle travel 61

(Fig. 11) now lies on the other side of the bolt. A further timing device in the control unit 37 now cuts off the supply of current to the motor until the next opening and closing of the door.

The contact for switching on the motor 2 which, hitherto, has been described as linked to the locking shaft 50, can also be replaced by a non-contact proximity switch in the door frame; in this case, the automatic door abutting mechanism also operates completely without contact in that part of the equipment fitted in the door which, having only one twin lead to the control unit, is not liable to failure, requires no maintenance and is also suitable for subsequent installation.

It is also possible to use a mercury switch to switch on the motor for shutting the door, this switch being actuated via an arrangement of levers, not illustrated, by the initial rotation of the forked lever 51 during the preliminary shutting movement so that it closes the current circuit to the electromotor. The system of levers is so designed that the mercury switch, before or on reaching the closed position of the door, is brought back to its original position by means of, for example, a return spring and again interrupts the current supply to the motor. The shutting mechanism in accordance with the invention can then also be brought back into the starting position, without moving the forked lever 51, in preparation for the next shutting operation, by renewed switching on of the motor with reverse polarity and/or by mechanical means, such as a spring. In addition to the mercury switch, a separate timing circuit can be provided to reverse the polarity and to switch the motor on again in the opposite direction of rotation.

WHAT WE CLAIM IS:—

1. Power shutting and/or locking device for doors, bonnets and lids of vehicles, especially motor vehicles, having shutting means and/or locking means movable from a shutting or locking position to an opening or unlocking position and *vice versa*, having further an electric motor drive including a flymass and drive transmission means including a transmission gear and interconnecting said motor drive and said shutting or locking means for moving the latter from either of said positions to the other in response to operation of said motor drive, characterized by the fact that said drive transmission means includes self-operated clutch means, transmitting drive forces to said shutting or locking means only after a delay time has passed since the start of operation of said motor drive.

2. Device in accordance with Claim 1, characterised by the fact that the transmission gear consists of spur gear transmission with connected rack and pinion drive.

3. Device in accordance with Claim 1, characterised by the fact that the transmission gear consists of a friction wheel drive with a connected rack and pinion drive or lever linkage.

4. Device in accordance with Claim 1, characterised by the fact that the transmission gear consists of a grooved roller spinning drive whereby the rotational movement of the flymass is directly converted into a translational movement required to operate said shutting or locking means.

5. Device in accordance with Claim 1, characterised by the fact that the transmission gear consists of a worm gear, the worm wheel of which is in the form of a spindle nut in which a threaded or roller spindle engages directly.

6. Device in accordance with Claim 5, characterised by the fact that the flywheel is mounted on the worm shaft.

7. Device in accordance with Claims 1 to 6, characterised by the fact that there is an element of idle travel in the transmission linkage.

8. Device in accordance with Claims 2 and 7, characterised by the fact that the toothed rack, after overcoming the idle play, is flexibly connected to the shutting or locking means in order that this can be unlocked by hand after having been moved to its shutting or locking position in response to operation of said motor drive.

9. Device in accordance with Claims 1 to 8, characterised by the fact that all control and regulating equipment for controlling the motor drives of the individual shutting and/or locking devices for several doors, bonnets and lids is housed in a central control box and includes time relays for supplying the individual motor drives with current for only a specific period of time and that each shutting or locking device is connected to said equipment by only one twin cable.

10. Device in accordance with Claims 1 to 9, characterised by the fact that the central unit is designed for separate or centralised locking.

11. Device in accordance with Claims 1 to 10, characterised by the fact that the central unit is connected to an alarm or warning system.

12. Device in accordance with Claims 1 to 11, characterised by the fact that a relay responding to sudden acceleration or deceleration is fitted in the central unit in conjunction with a time relay.

13. Device in accordance with Claim 7, characterised by the fact that said electric motor drive comprises an electromotor and a flywheel fixed to the output shaft of the electromotor, that said output shaft is connected to an input gear wheel of a reduction gear the output gear wheel of which engages in a toothed rack, that the toothed

rack has an upper and a lower stop face, that a pull rod is linked to a locking lever of the shutting or locking means, that the pull rod has an upper stop which can engage with the upper stop face of the toothed rack, that the pull rod has a lower stop which can engage with the lower stop face of the toothed rack and that the distance between the stops on the pull rod is greater by the amount of idle travel than that between the stop faces of the toothed rack, with the result that, at the commencement of each movement of the shaft, reduction gear and toothed rack, the toothed rack can, without the use of force, pass through the idle travel before its corresponding stop face engages with the appropriate stop of the pull rod and the operating stroke begins.

14. Device in accordance with Claim 13, characterised by the fact that the toothed rack is in the form of a sleeve section with rack toothing and that the pull rod passes through the central hole of the sleeve section.

15. Device in accordance with Claim 7, characterised by the fact that the common shaft of the electromotor and flywheel acts on a connecting rod via a toothed or friction wheel intermediate reduction gear and a crank pin fixed eccentrically to the take-off wheel of this intermediate gear, that one end of the connecting rod is pivoted on a locking lever of the existing locking mechanism and has, at its other end, an axial longitudinal slot and that the crank pin engages in the longitudinal slot, so that the crank pin does not engage with the connecting rod at the lower or upper edge of the longitudinal slot, for the purpose of transmitting the power, until after the idle travel in the rotation of the take-off wheel.

16. Device in accordance with one of Claims 13 or 14, characterised by the fact that the electromotor is a D.C. motor, the direction of rotation of which can be reversed for the locking procedure and the unlocking procedure by reversing the polarity of the supply voltage.

17. Device in accordance with Claim 16, characterised by the fact that the central control unit contains equipment which, depending on a locking or unlocking signal from the switch contact of a door lock, ensure the supply of current of one or other polarity to the motor or motors.

18. Device in accordance with Claim 17, characterised by the fact that the control unit contains electronic timing devices which, after the operation of a switch contact, keep the motors switched on for a specified period only and at the same time prevent reversal of the polarity of the supply voltage while the motors are running.

19. Process for the operation of shutting means and/or locking means of a power operated shutting and/or locking device, especially of doors and the like of a vehicle, the shutting or locking means being movable from a shutting or locking position to an opening or unlocking position or *vice versa* by an electric motor drive via drive transmission means, characterised by the fact that in order to move said shutting or locking means from either of said positions to the other the motor drive is first accelerated for a specific period to a predetermined speed of revolution and that, after this period, said drive transmission means is actuated to interconnect said motor drive and said shutting or locking means to transmit the energy of rotation of the rotating parts of said motor drive for moving the shutting or locking means.

20. Process in accordance with Claim 19, characterised by the fact that the transmission mechanism contains a gear wheel, friction wheel or worm reduction drive.

21. Process in accordance with one of Claims 19 or 20, characterised by the fact that the transmission mechanism has an element of idle travel, as a result of which the input part of the transmission mechanism must first traverse a certain distance (=idle travel) and thus a certain time, before there is any coupling of the input part and output part of the transmission mechanism.

22. A power shutting and/or locking device for doors, substantially as described herein with reference to and as illustrated by the accompanying drawing.

23. A device as claimed in Claim 1, substantially as hereinbefore described.

24. A process method as claimed in Claim 19, substantially as hereinbefore described.

For the Applicants:
MATTHEWS, HADDAN & CO.,
Chartered Patent Agents,
33 Elmfield Road,
Bromley, Kent.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1978.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.

1530716 COMPLETE SPECIFICATION

10 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig. 1

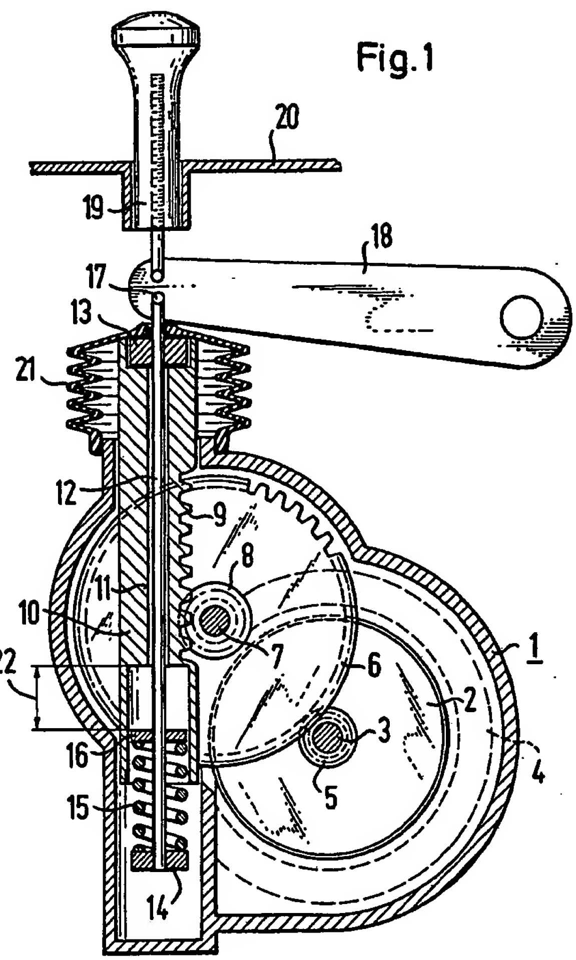


Fig. 2

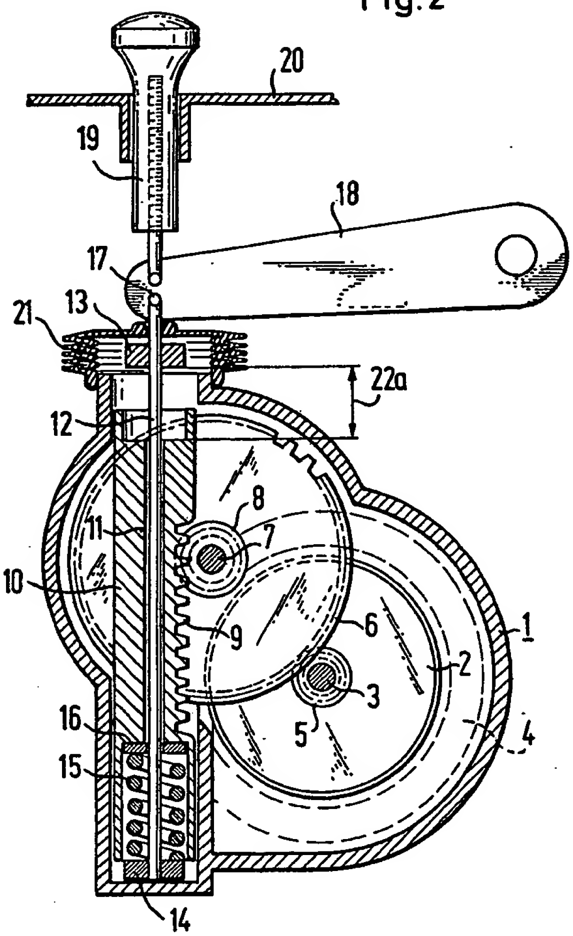


Fig. 4

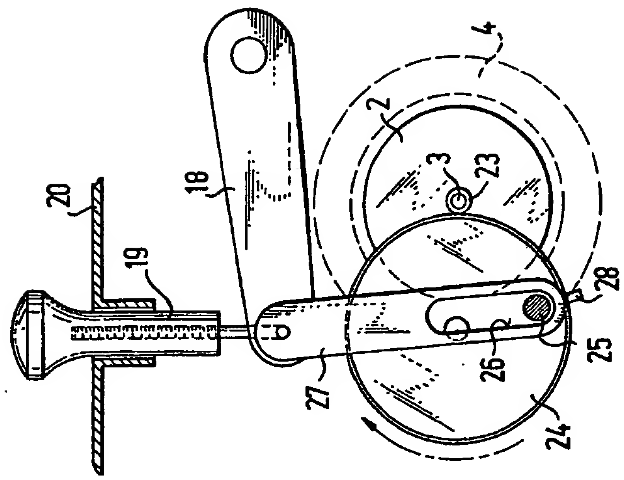


Fig. 3

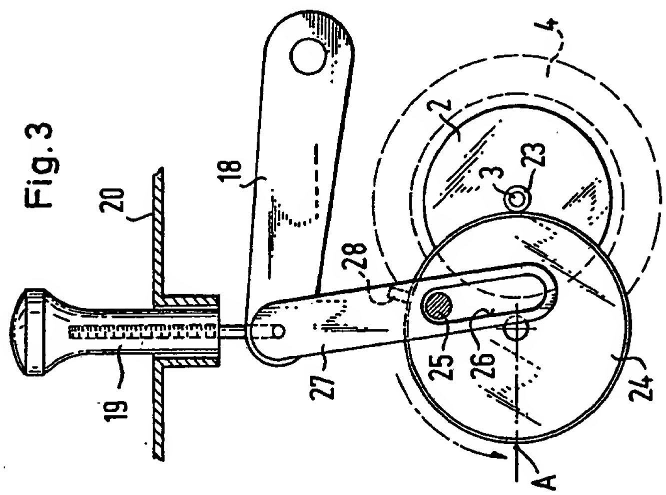
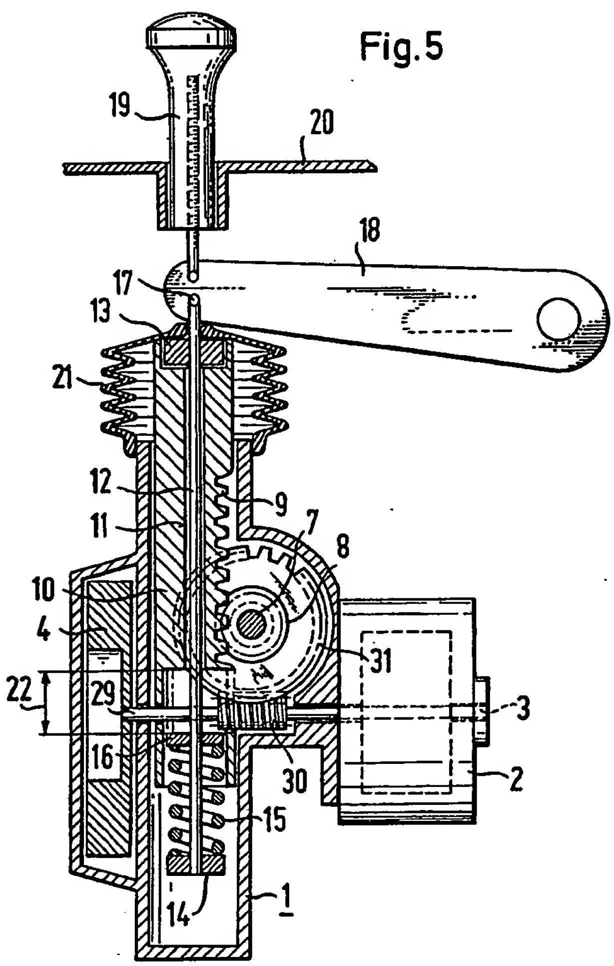


Fig.5



1530716 COMPLETE SPECIFICATION

10 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 5

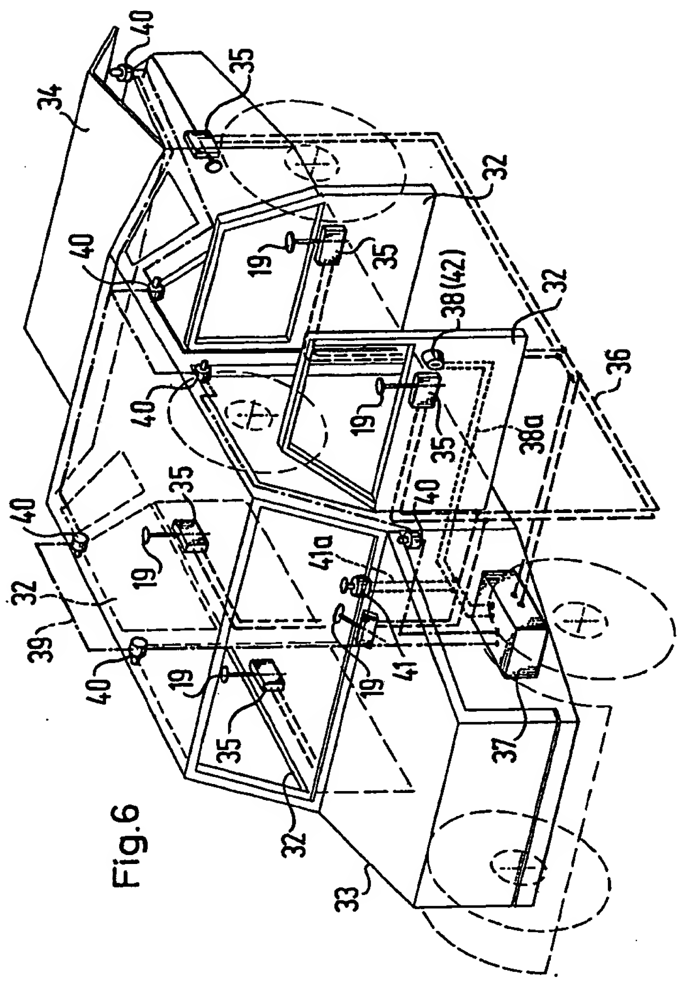


Fig.6

1530716 COMPLETE SPECIFICATION
10 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 6

Fig.7

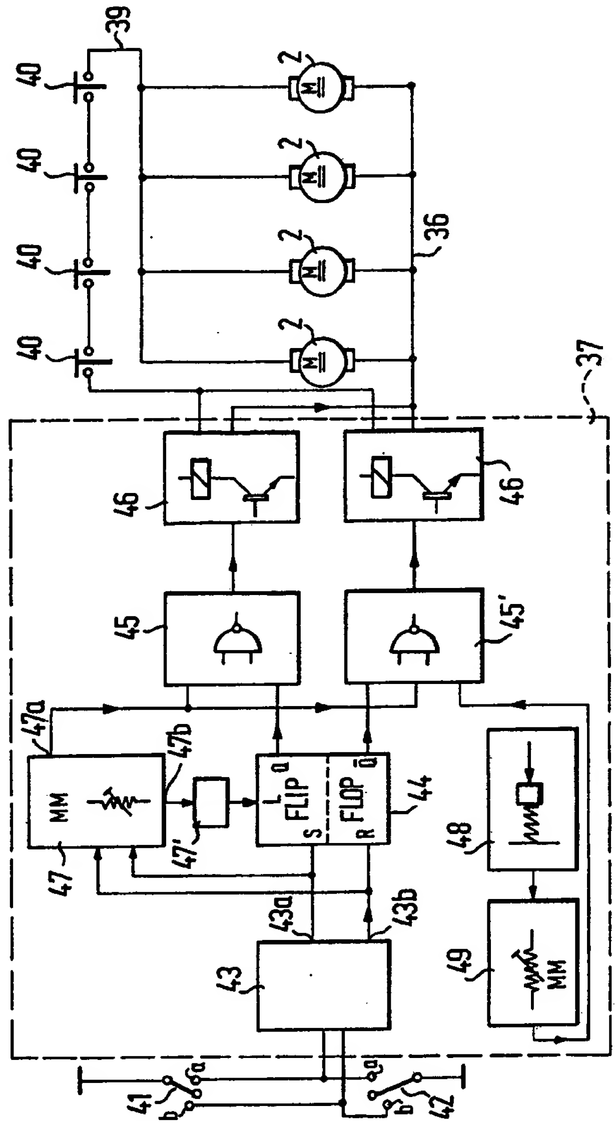


Fig.8

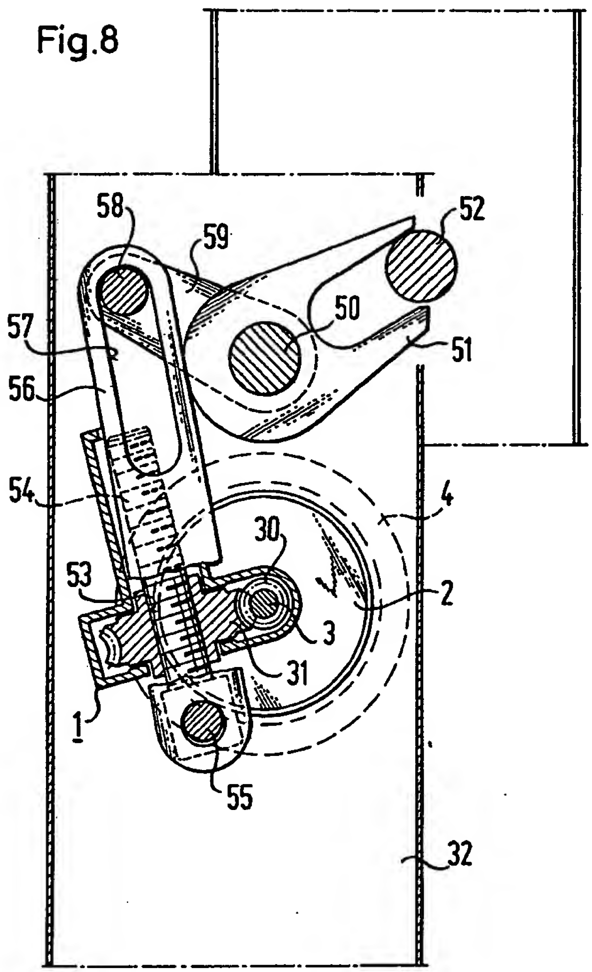


Fig.9

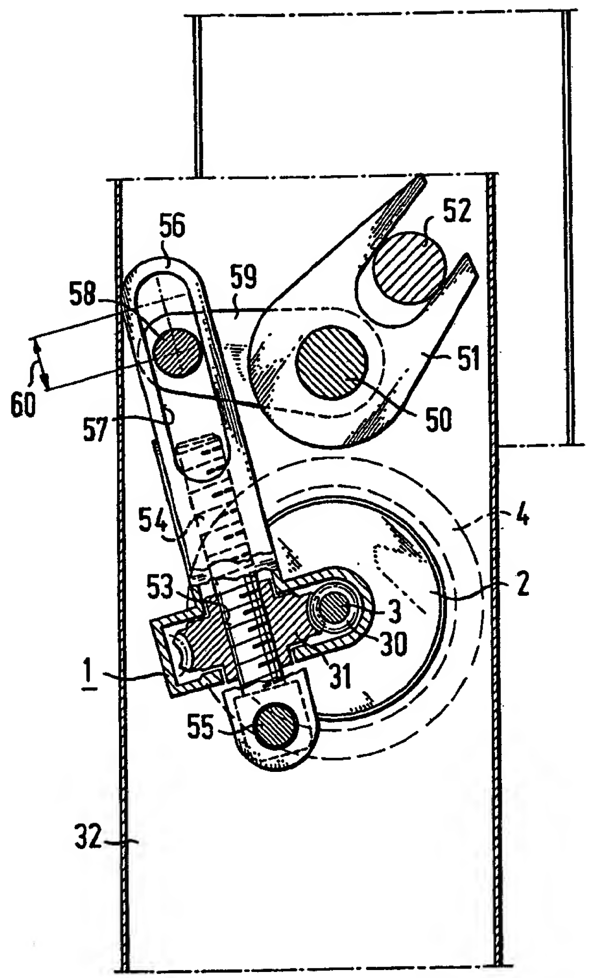


Fig.10

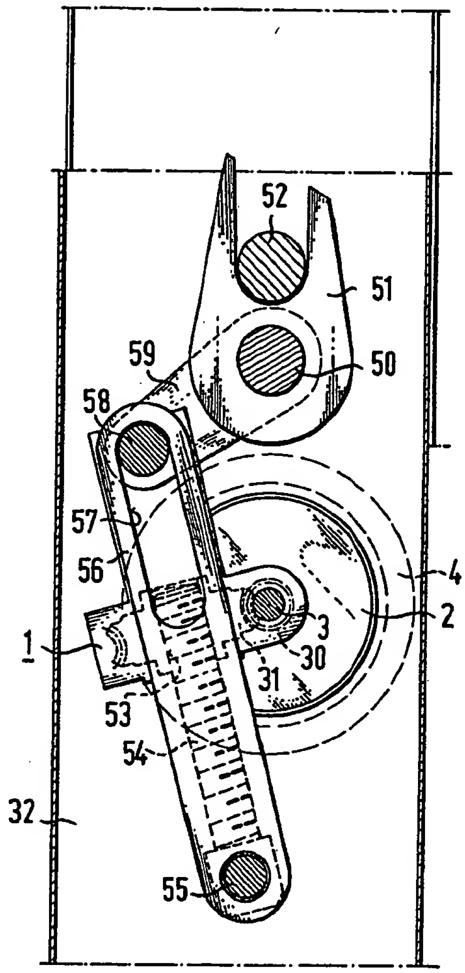


Fig.11